Associate editor decision: Submit a revised manuscript
by Shigeru Sueoka
Public justification (visible to the public if the article is accepted and published):

This manuscript has been reviewed by two referees. Both reviewers recognize the significance of this work and consider it a useful and practical contribution for researchers conducting thermal history inversions using thermochronological data. The comments provided by the reviewers are generally minor and mainly concern clarification of certain points, refinement of wording, and correction of typographical errors. No major concerns were raised regarding the methodology, results, or overall conclusions of the manuscript. Therefore, I consider that the manuscript is suitable for publication after the authors address these minor comments.

Reviewer 2 suggested adding a comparison with other thermal history modeling software (RC2). This is an interesting suggestion, and such comparisons may indeed be valuable in future studies. However, I agree with the authors' response (AC2) that a comprehensive comparison among different thermal history modeling platforms is beyond the scope of the present Technical Note. The primary objective of this manuscript is to introduce and evaluate the enhanced CRS approach implemented in HeFTy v2, particularly through comparison with the existing MC strategy, rather than to provide a benchmark assessment among different thermal history inversion software.
Furthermore, comparisons among thermal history modeling approaches require careful consideration because differences in algorithms, parameterizations, and acceptance criteria can strongly influence the resulting thermal histories. A comparison based on a limited number of simple examples may not provide a sufficiently informative assessment of the relative capabilities of different approaches and may risk obscuring the main objectives of this Technical Note. Therefore, I do not consider the addition of such a comparison necessary for the current manuscript. I encourage the authors, however, to clarify this scope and rationale in the revised manuscript where appropriate.

Author Response:

Dear Shigeru Sueoka,

Please find attached a revised manuscript. We have made the minor changes suggested by the two reviewers, as described in a point-by-point manner in our previously posted AC on each reviewer comment. We agree with your assessment of R2's suggestion to add a direct comparison to other converging algorithm. We also took the opportunity to make minor adjustments to grammar and wording.

The most substantial change is in the deep-time example and accompanying text and Figure 5. As described in our AC to R2:

"This comment has also prompted us to revisit the comparison we are making here (between the published MC and the new CRS results). The published MC result was generated using HeFTy v1.9.3. The transition to HeFTy version 2 was accompanied by an adjustment to how the composite GOFs (and thus the classification of attempted paths as good, acceptable, or not accepted) are calculated, to make it slightly more forgiving. Therefore, this new statistical schema, and not the CRS, may be contributing to finding the new family of acceptable-fit solutions (e.g., permissible hotter peak T in late K time). In order to make a more clear

comparison, we intend to re-run the MC inversion in HeFTy 2.3 and use that result here instead of the published one. We do not anticipate this will change the discussion here substantially."

We re-ran this published MC inversion as a MC inversion HeFTy v 2.3, and indeed the result is different enough to warrant briefly discussing the difference and then using the v 2.3 MC result to compare to the CRS. We added a paragraph starting at new line 413 that compares the two MC results. We present both results in Figure 5, and have added a visualization of the fit to the ZHe age-eU trend as well, because of the difference in statistics between v1.9 and v2.3. As we anticipated, this addition provides an improved comparison between the MC and CRS algorithms in the current version of HeFTy but does not change the discussion or findings substantially.